TABLE OF CONTENTS

Preface

I. The Witten / Herdecke University

II. What are the advantages of a Private University compared to a State University?

III. How does the Institute of Environmental Engineering and Management finance itself?

IV. The IEEM

V. From our work
At the IEEM - Institute of Environmental Engineering and Management at the Witten/Herdecke University - the academic fields of "technology" (engineering) and "economics" (including finance) are combined to an applied scientific approach. Technology and economics are the essential fundaments of our work, and a precondition to develop modern management concepts and organisational models, which are needed to design and realise both technical and institutional solutions, focused on efficiency for environmental protection and supply services.

The initiative to link these two traditional fields of science originates from wastewater management. Meanwhile, the sector "water and sanitation" is fully covered by IEEM, including the fields of water supply, solid waste management and recycling, as well as environmental engineering and management.

Academics drive practitioners to apply novel solutions, as well as practitioners drive academics to focus on the real world. As an independent institute at the Witten/Herdecke University, we have all opportunities to balance scientific based services and research. The institut’s priority is to seek for valuable, appropriable solutions. Practical applicability and a solid, scientific fundament are unified in a perfect way at our institute IEEM.
The Witten/Herdecke University was the first private university in Germany, founded by initiative of scientists and medical doctors in 1983 as autonomous but officially recognized body.

Freedom from state regulation is seen as a chance for responsible organisation of curricula, research and university management. The Witten/Herdecke University provides a suitable context for all its members, to develop special competences and pursue personal ideas for the benefit of society and environment, under conditions of autonomy and freedom (www.uni-wh.de).

The Witten/Herdecke University is obliged to holistic, integrated thinking and approach in tuition as well as in research. Faculties and disciplines are not dealt with separately, but always in context with their interlinks and overall aspects. Medical students learn with the patient, onsite in the hospital, how medical agents, medical technologies effect the human being and its environment. The student of economics is not limited to theories or strategy models, but has to experience by working for partner-industries, what and how far ambitious theories can be applied technically, logistically and financially - and why a lot of theories and management ideas fail, in practice. In research, biologists, medical doctors, chemists, physicists and mathematicians co-operate in joint programmes with industry.

The Witten/Herdecke University enthuses students, staff and patrons alike. There were famous leaders from industry and banks, like Alfred Herrhausen, Reinhard Mohn, Berthold Beitz and Gerd Bucerius, who wanted a truly free university. On the occasion of opening the Witten/Herdecke University, Alfred-Herrhausen said the following: "It is essential to create conditions that make it possible to fully develop and exhaust all the capabilities and talents that are present in the community." The Witten/Herdecke University realizes this concept day by day.
II. What are the advantages of a Private University compared to a State University?

Being public servants, lecturers and professors at state universities are allowed to develop their entrepreneur spirit only to a very limited extent; they have to comply with the German legislation for public services limiting their opportunities to raise funds. Of course, public professors do have certain options. Anyhow, the employees of a state university, the doctorate students, graduate students as well as tutors often have difficulties to fulfil the ambitious task of lecturing and research. No wonder, that successful initiatives have developed not with, but "against the public system", in case that public universities have to establish private affiliates, or specific legal vehicles to escape these limitations of the public university organisation.

From the beginning, the IEEM has been organised following the principles of efficiency under private legislation. This allows to adapt easily to the needs of practical application, and to cope with requirements from the industry. Furthermore, IEEM is able to select their leading staff according to their know-how, including experienced, high-ranking experts from business and technology enterprises. Its staff is paid depending on their qualification and work output.

And what is true for scientific, technical and administrative staff, is even more applicable for their leading staff and professors. They are called and assigned based on scientific qualifications which have to be outstanding, and apart from that, they have to prove excellency in successful practical application of water engineering and management.

The "Prof" is not only professor, he must be professional. He has to guarantee that IEEM’s outputs are ready for practical verification and (in a later stage, at least) application.

Additionally, clients from industry prefer to co-operate with the private university institute (compared with bodies under public administration), because it is equally exposed to economic working conditions like private business. Scientific assignments and research contracts can be equipped with confidential agreements and binding time schedules - even including penalties or incentive payments to enforce contract compliance. If the client wants it, and supports the work sufficiently, we will do whatever it takes to get the job done.
The IEEM - Institute of Environmental Engineering and Management at the Witten/Herdecke University, is an autonomous, non-profit company. It is acting in freedom, fully independent, and it has to take care for self-financing its full cost (!), including all investments and running operational costs.

For this purpose, the staff of IEEM delivers scientific services, such as research work, scientific advise, expert opinions, licence sale and development of technologies and special purpose technology development on the requirement of clients.

Due to its institutional status and the German tax legislation for non-profit institutions, IEEM is not allowed to deliver consulting work, be it engineering or business consulting, especially engineering design or management support. If such services are requested, IEEM will act in close co-operation with commercial consulting companies of outstanding qualification, so that suitable methods, concepts, solutions can be developed and implemented case-wise.

A reasonable balance is needed between scientific services and academic research:

If the scientific staff does not have sufficient time for research, fulfilling their assignments focused on practical application, the scientific fundament would "dry out", on the long run. On the other hand, any university institute, which has no links to practical application, only executing academic research, would quickly lose sufficient understanding of the real world - leading to "pure science" (and eventually "poor science").
IV. The IEEM

Prof. Dr.-Ing. Dr. rer. pol. Dr. h.c. Karl-Ulrich Rudolph
Director of IEEM

Since its foundation, the IEEM - Institute of Environmental Engineering and Management at the Witten/Herdecke University gGmbH, has remained unique in its strong integration of technical (engineering) and economic (management) issues.

We focus on topics of water and sanitation, closely linked to applied environmental economics. Research and development activities of IEEM for cost-optimisation in the wastewater sector have had a strong impact on the German discussion (and even legislation), especially regarding the so-called "optimised municipal utility model", the various PSP (private sector participation) models, like the BOOT (Build, Own, Operate and Transfer) model, and other organisational models (e.g. affermage, semi-concessions and hybrid models), for which IEEM pioneered in research and scientific advise for implication.

The continuous effort to approach a sustainable, economic optimum (including ecologic long-term aspects) has always influenced IEEM's technical activities. Ongoing projects deal with water efficiency, especially water leakage reduction programmes in supply networks, using remote monitoring and control, with novel wastewater disinfection, with process water purification from sludge dewatering facilities, with specific concepts for wastewater re-utilisation and space-efficient construction design of large sewage treatment plants.

As it has already been in the past, international co-operation is getting more and more important. This applies to industrialised countries in the western world (e.g. Japan, USA, Australia), to transforming regions (Algeria, Russia, South Africa, Vietnam), and even more to so-called developing countries (Armenia, Yemen, Kenya, Nicaragua, etc.). According to our approach "High Brain - Lean Tech", IEEM researches and develops concepts for stage-wise construction and enlargement of sewage treatment plants, which are easier to be financed, using simple and cost-efficient civil construction (preferably built by local companies) in connection to intelligent process technologies (from developed countries). Delegates from IEEM work in important technical associations, boards, working groups, such as the International Water Association (IWA), the German Water Association (DWA), Association of the German water and recycling industry (BDE), Association of the German Industry (BDI). Furthermore, IEEM is included in co-operated projects with several other scientific institutions, funded by World Bank, by the European Union, by German Federal Ministries (especially BMBF) and others.
V. From our work

The international focus of IEEM’s activities goes along with the regional development of the world water sector.

IEEM is active in engineering and management, specialised in water sanitation and waste, with research and lecturing both on national and international level.

The close integration of technical and economic know-how is essential to IEEM. Based on such a holistic understanding, the engineers and economists at IEEM are able to develop and deliver cost-efficient technical and environmentally friendly solutions in water supply and wastewater management, including water re-utilisation as well as solid waste management and recycling.

The limiting factor of success is not necessarily a lack of financial budgets; more often, there are political and institutional deficits, counter-productive incentives and technical-economic structures that fail, causing an insufficient water management, which leads to a lack of service performance in water supply and sanitation.
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Metropolitan Lima, Peru
- 8 million inhabitants,
  annual growth rate: 2.1 %
- Mean annual precipitation: 9 mm
- Water supply: River Rimac

Increasing Groundwater abstraction
- 81 % of population is connected to sewage system
- Wastewater production: 18 m³/s

Objectives of the project
- Investigation on existing and promising innovative water technologies
- Pilot installation in Lima

Modelling of water and resource fluxes
- Evaluation of concepts of water utilisation
- Implementation with strong involvement of SEDAPAL water company and local NGOs

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Asia-Invest II-Projects

**EMACS**
Environmental Modular
Advanced Compact Systems
in **China**

**FEMIPI**
Facilitating Environmental Management
and Investment by Polluting Industry
in **Thailand**

**SEISME**
Stimulating Environmental Investment by **SMEs**
in **Vietnam**

**ASIA** has a rapidly growing community of Small and Medium-sized Enterprises (SMEs) active in a number of polluting sectors. To mitigate their environmental impacts, these SMEs need adapted and low cost pollution control systems.

**EUROPE** is the seat of numerous developers of environmental technology. The projects, co-financed by the European Commission, shall assist the partners to develop value adding consultancy to Asian SMEs in two complementary directions.

→ Capacity Building and Design of locally adapted environmental and technological solutions, together with local industry associations, addressing the problems of SMEs in selective most polluting sectors.

→ Business development of these technological solutions in Asia in co-operation with EU technology partners.

Our Partners in Asia and Europe:
The project aims at documenting and benchmarking of a selective number of SME PEPS producers and production processes in Europe. It assesses the prospect of transposing such business models to three rapidly industrialising and urbanising Asian countries/regions (Thailand, China/ Jiangsu Province, Vietnam). This dynamic development results in an increasing demand for know-how of efficient wastewater treatment technologies. Modular compact treatment systems allow an economic realisation of decentralised wastewater treatment for special demand of emerging enterprises.

Within the project about 5 to 15 European SMEs PEPS providers, will be analysed regarding the structure and cost profile to be identified and mobilised as "test PEPS business models" at the beginning of the project. Then the cost structure of transposing representative PEPS production processes in the three target Asian countries will be assessed. Finally the value of the study will be rounded up by an investor guide for European PEPS providers, through a review and documentation of PEPS segmentation, market prospects and trends, regulatory PEPS market drivers, barriers and actors as well as incentives and privileges for foreign investors available in these countries.
The IEEM participated in a joint project with the local water supplier St. Wendel GmbH (WVW) and the Fraunhofer Institute of Systems Engineering & Innovation Research. The intention was to determine the economic potentials of establishing telemetering for optimised water supply management. The main focus of the project was on developing integral centralised data processing for leakage control and implementing planning aids for reinvestment strategies.

The scientific support of IEEM covered all technical issues regarding the implementation of the telemetric system for network control and leakage reduction.

The rural service area of WVW was classified into 17 monitoring sectors with telemetric reading of bulk. This system showed that early leakage detection results in lower extent of damage and reduced operational costs.

Due to the results of this pilot project, effects of an optimised pipe dimensioning were analysed for future reinvestment planning. In cooperation with the Fraunhofer Institute a cost-benefit analysis was worked out for telemetric network monitoring in the project area. An adaptation to bigger water supply systems also showed an economic benefit of telemetric leakage control measurements.

The costs of telemetering seem uneconomic for most of the utilities in Germany as long as the evaluation is restricted to the status quo and short-term benefits. In the long run the costs for telemetering will drop significantly, as more units are being sold worldwide. Hardware and software will become more cost-effective in the future.
The prices for telemetering have already come down as a result of technological development. As long as there are overcapacities in German water systems, improved technical control, e.g. peak-flow reduction, will not offer any great benefits. However, the situation is quite different for some industrial consumers and in countries with water shortages, for example in Eastern Europe or the Middle East. The extra costs for telemetering may very well be outweighed by the benefits arising from more sophisticated network operation and water pricing.
Methods for the reduction of water losses in distribution networks mainly come from the western developed countries. The transfer of these methods, considering the specific conditions in Iran, has been exemplarily investigated in Esfahan, an Iranian city with more than one million inhabitants.

Within the project IEEM has been working on leakage control system and water loss reduction techniques. The focus was the on transferability of detection measurements and infrastructure management methods of western developed countries to arid transforming and emerging countries.

Considering technical, economical and management aspects, this evaluation should lead to an efficient adaptation of these methods to arid transforming countries.
This international co-operation project was realised together with the MVV Energie AG, Mannheim, Germany, and the Esfahan Water & Sewage Company, Iran.

The project report covers an overview of the topics of water loss reduction and Iranian water supply situation, remarks on sustainable network management by organisational means and training programmes, as well as typical problems of implementations of water loss reduction programmes in arid developing and transitional countries.
With funding from the German Federal Ministry of Education and Research (BMBF), the IEEM-Institute of Environmental Engineering and Management at the Witten/Herdecke University and the Center for Development Research (ZEF) at the University of Bonn jointly develop methods and tools for an IWRM concept, which can make a contribution to the improvement of today's water use and supply situation in the Middle Olifants area.

The project is located in the Middle Olifants, a river catchment area situated between Pretoria and South Africa's eastern border to Mozambique.
Valuable support is being provided by South African institutions as the University of Limpopo, the Water Research Commission, the Department of Water Affairs and Forestry as well as the private company Botjheng Water (Pty) Ltd.

The project consists of four parts: a simulation of the river catchment area, an economic analysis of water uses, a model of intervention measures (including regulative and executive measures for realising the IWRM), as well as a pilot project of a franchise concept for the water supply sector for private consumers, which shall generate a technology transfer from an experienced water and sanitation services provider to local service providers.

In this context, IEEM is responsible for the simulation of the river catchment area Middle Olifants. This software based model will take into account all in- and effluents and will be able to compute, how exogenous effects influence the quantity of water that is available to the people at different points of use. The economic model will be developed by ZEF. For this purpose, surveys have been conducted locally at household, agriculture and industry levels. It is the main objective of this module to visualise and quantify economic consequences of policies aimed at improving water use efficiencies. The institutional framework will be researched and integrated by both partners.

The project partners expect to develop a powerful IWRM model through the interdisciplinary combination of economics, engineering and ecologic sciences.
The technological improvement of electronic control systems enables advanced remote control. Online monitoring measurement quickly transmits flows and specific pollutant loads in wastewater systems. High capacity data processing enables simulation of different conditions for drainage, stormwater retention and treatment processing. Integrated control systems allow efficient handling of specific situations which result in higher treatment efficiency and lower costs especially in established communal wastewater systems.

Exemplarily shown in Emmerich am Rhein, a new process control system has been introduced. The combination of sewer and environmental data processing, sewerage and treatment system simulation & calibration and centralised remote control of regulation devices (pumps, valves ...) is the first step of developing an "intelligent agents" software.

By integration of stormwater disposal and wastewater treatment through the control system a leveling of wastewater flows and loads to the treatment plant and an optimised stormwater retention management should be achieved.

This project will highlight the improvements of receiving water ecology, treatment efficiency and economical aspects as well as the transferability of this control system to other sewer systems with different specific conditions.
Wastewater treatment in industrial WWTPs like Gemeinschaftsklarwerk Bitterfeld/Wolfen demands a high-level of engineering know-how. The treated sewage water must continuously fulfill the strict legal limits for discharged water. Stability of cleaning processes must be guaranteed even under conditions of changing wastewater composition due to variable industrial production.

- Optimised processing of wastewater input due to volumes and loads
- Higher treatment efficiency
- High standards of wastewater parameter analysis
- Amplification of process stability systems
- Implementation of highest technological standards
- Integral process control of sewer system
- Standardised control mechanisms of all associated sectors

- Integral standardised hard- and software solutions
- Accurate external alarm and control data communication
- Centralised internal data processing for instantaneous access
- Optimised shift-working and alarm standby availability
The project area is the area served by the public water and wastewater association Wasserverband Wittlage (WVV).

It is part of the catchment basin to the Lake Duemmer, a highly sensitive ecosystem of European importance (Natura 2000, FFH and bird protection zone).

Within this area, not only tourism is of social and economic importance, but also agriculture and industries (especially food production industry; some factories are among the largest in Europe).

The IWPM - Integrated Wastewater Purification Management project was awarded by the European Union as „Best of the Best“ EU-Life Environment Project of all EU-Life projects finished in 2012.
The innovation of the IWPM-Project is a functional link between the sewage treatment plants (STP) in Bad Essen and Ostercappeln with a biologically activated pipe. IWPM means that hydraulic flows and contaminants can be equalised and distributed to an optimum between both STPs.

The general flow chart of the STP Bad Essen with all IWPM components (yellow marked) is displayed above.
Within a BMBF-sponsored joint research programme about the adaptation of wastewater treatment and water reuse technologies with respect to specific conditions in different regions this project deals with the particular aspects of wastewater treatment in ponds and lagoons. One focus is on hygienic aspects and the possibilities of effluent disinfection by UV irradiation.

Evaluation of design and operational parameters of wastewater pond systems

All over the world wastewater pond systems represent a significant share of wastewater treatment facilities, especially in developing and newly industrialising countries. With relatively low operation requirements, waste stabilisation ponds are often a reasonable choice for sustainable wastewater treatment in remote areas with unreliable electricity supply but enough space resources.

But also in industrialised countries pond systems are important options within decentralised concepts for wastewater treatment. High-brain approaches like combined systems offer solutions for rising purification requirements and efficient operation.

By international surveys within the research project relevant design parameters and operational experiences of pond systems have been evaluated with respect to specific conditions (climate, sewage characteristics, demand for reuse etc.) in different regions world wide. The condensed results will be part of a guideline about wastewater treatment abroad.
Wastewater disinfection by UV irradiation

Wastewater treatment for water reuse is especially dominated by the question of pathogenic contaminations. Because of their long retention times, properly designed pond systems have a high performance in terms of pathogen reduction.

Based on general investigations about wastewater disinfection technologies within the project the specific effects of natural and solar disinfection in pond systems have been to be clarified.

Additionally, practical tests with UV irradiation of pond effluents have been conducted together with the industrial project partner WEDECO. Aim of these tests is the investigation on the performance of subsequent disinfection by UV irradiation for different qualities of pond effluents.

![Diagram of Wastewater Pond System](image1.png)

![Lagoon System (fictive)](image2.png)
Green spaces are essential for life in arid urban areas as they positively influence the local climate and reduce the appearance of dust. To keep these spaces in a proper condition despite arid climate they have to be intensively irrigated. Even in regions with scarce water resources, mostly potable water from public water supply systems is used for this purpose. Particularly in arid developing countries, also completely uncontrolled use of raw wastewater for irrigation purposes is widely spread, with all the hygienic problems linked to this.

Within a joint research project sponsored by the German Federal Ministry of Education and Research (BMBF), at first a decentralised system for the controlled utilisation of sewage as irrigation water in public green spaces has been developed for an example location in Algeria.

In addition to the technical treatment concept, a multi-barrier strategy for hygienic risk management has been outlined, covering following aspects: water reutilisation suitable with respect to the site conditions, as well as suitable handling and treatment of raw sewage.

The practical application of the concept including a pilot treatment system for the utilisation of raw sewage takes place together with the Hans Huber SE in the United Arab Emirates. The compact and easy to handle system includes the treatment steps separation, sedimentation and disinfection.
For the wastewater disinfection UV irradiation has been identified as most appropriate in the specific context. To support the operation of the pilot system, experiments with UV disinfection on laboratory scale were carried out, technically supported by WEDECO AG.

To verify the feasibility and acceptance of the concept, a market study as well as an accompanying socio-economic study will be drawn up by IEEM, taking into consideration the specific local and regional conditions.
Liquid manure from factory farming is usually spread directly onto the fields as liquid fertiliser. Undesirable eluviation to groundwater occurs if the soil's nutrient uptake capacity is exceeded. In order to reduce negative impacts on soil quality two treatment steps are necessary: separation and treatment by floated rotating contactors.

Separation of solid particles (e.g. litter) results in a first reduction of the organic load. This material is appropriated for composting. The liquid manure is easier to be handled in pumping or storage due to the reduced amount of solid impurities.

Then the separated liquid manure is treated biologically during a longer storage period. As known from communal wastewater treatment, a submerged rotating contactor is used as the water level of the treatment plant tanks is not constant. For changing water height the contactor device has to swim on the surface in order to enable an optimum submerged-aerated ratio.

The total contactor surface area is about 1,500 m². This biofilm reactor is composed of sessile micro organisms where ammonium (NH₄) is oxidized to nitrate (NO₃) by bacterial metabolism. Ammonium oxidation happens during the aerated phase. During the submerged phase anoxic conditions occur, then nitrate is used for further oxidation and pure molecular nitrogen is released. Oxygen intake is realised by rotating these discs covered with biofilm. The energy demand for rotating is much lower than for air injection or mixing.

Processing by separation and submerged-rotating contactors is an efficient, cheap and robust method with low maintenance requirements.
Sludge treatment in sewage treatment plants (thickening, digesting, dewatering, drying etc.) processes high concentrated sludge liquor return, which can cause back charges (up to 30% of the nitrogen carriage) in treatment processing and affect the necessary size of the activated sludge tank volume.

A simple pre-treatment procedure to reduce the nitrogen input has been developed as a new and very economical alternative. Swimming rotating biological contactors are inserted in buffer-cells or closed clarifiers. Depending on the influent flow of the sewage plant the pre-treated sludge liquor is mixed to the inflow.

Due to preliminary tests and analogy observations of similar technologies, for example liquid manure treatment, a general case adequate efficiency of approx. 50% (total nitrogen elimination) and treatment expenses of approx. 25% are expected. This progressive application will result in much more efficient sludge treatment.
Participation of private companies in public sector service in Europe has become as an efficient and advantageous system. Technical know-how of private companies and their economic adjustment promise synergy effects at engineering and business level.

In operator models private enterprises build and operate public infrastructure over a fixed long-term period. This results in a closer consideration of short-term investment and long-term operation costs. Especially for the development of sewage systems in developing and emerging countries this is a promising model and seems often more suitable than a solely governmental driven management.

Our study compares experience with PSP-models in Europe on the water and sewage sector. The focus is on feasibility and transferability to South-East-Asian markets.

**Private engagement as basic principle for investment and management promises:**

- **Cost minimising** on open competition
- **Technical and economical achievement**
- **But no coverage** of political risks (capacity risks, encashment, etc.)

The Franchise model for Water Sector is the result of further development of existing models. The Model won the World Bank Award in 2006.
Sustainable operations and maintenance of water utilities and their relevant infrastructure are needed to keep service quality on a high level and to reduce costs. This applies to developed as well as to emerging and developing countries. Particularly in emerging and developing countries, the restraining factor is the lack of craftsmanship skills rather than a lack of available technologies.

<table>
<thead>
<tr>
<th>Local Service Providers (LSP)</th>
<th>Professional Water Company (PWC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td><strong>Weaknesses</strong></td>
</tr>
<tr>
<td>Located near to the job</td>
<td>Located far from the job</td>
</tr>
<tr>
<td>Low staff costs</td>
<td>High staff costs</td>
</tr>
<tr>
<td><strong>Weaknesses</strong></td>
<td></td>
</tr>
<tr>
<td>Water specific expertise limited</td>
<td>Professional water expertise</td>
</tr>
<tr>
<td>No financing power, short term business only</td>
<td>Sufficient financing power, mid- and long-term business possible</td>
</tr>
</tbody>
</table>

For a long period, PSP (private sector participation) models proposed a way to fill this know-how gap. However, in recent years, public resistance against these models increased significantly. As answer to this problem, the franchise concept (known from being successfully implemented by McDonald's, Hilton Hotels etc.) was transferred to the water sector. The concept aims at training and enabling local service providers by internationally experienced water service providers to take over operational and maintenance tasks.

With support from the World Bank (through a Development Marketplace 2006 Award), a pilot implementation of the concept was realised in a South African community located in the vicinity of Nelspruit, close to the Kruger National Park.
People in Germany take unlimited water availability for granted. The Sauerland region for example has an annual precipitation of 1,300 mm. There for sun-loving people rain seems to be even an annoyance. Of course the situation is absolutely different in other countries. An annual precipitation less than 100 mm causes problems that can only be solved with modern technology and efficient management.

International water management demands as much know-how about high-tech solutions as about low-cost implementations. A lot of countries fail with very trivial problems, which result in sanitation deficits, ecological devastation and miserable living standards. Often the limiting factor in developing countries is not a lack of money but an inefficient organisational structure in water management.
Almost no other branch depends so heavily on foreign market development. Almost no other sector allows a comparable interaction of business interest and holistic concepts for social and ecological enhancement.

There is a wide-ranged combination of academic concepts with practical demands and engineering know-how with economical foresight. High dedication to the job is absolutely necessary even under contrarious conditions.

For reasons of investment costs there are only public standpipes, piletas in the suburbs of Chiclayo (Peru). Water is only available for two or three hours per day, so it's an important local social center.

In many cases people are poor and technical equipment must be protected from burglary and the vandalism. This valve shelter of a water reservoir in Kavaja (Albania) is also a wet and cold sleeping place for the operating personnel.

Even a high-tech compact wastewater treatment plant – picture: automatic stainless steel screen - is useless without qualified operation and maintenance in Kisumu (Lake Victoria, Kenya) this investment in technology is useless without investment in instruction of skilled workers and management.

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Due to insufficient management this reaction basin for chemical precipitation in a treatment plant in Tumbes (Peru) is out of order after the last El-Niño flooding.

After a failure of the automatic chemical-proportioning device (water works in Trujillo, Peru) manually dosing of additives is done now. This results in adding chemicals on instinct which leads to a higher consumption and an unbalanced water quality.

In many cases people are poor and technical equipment must be protected from burglary and the vandalism. This valve shelter of a water reservoir in Kavaja (Albania) is also a wet and cold sleeping place for the operating personnel.

Economical and social standards are often significantly lower than in Germany. This results in very different technical realisation and construction sequence management. This picture shows reconstruction of a sludge retention dam base in Nyeri (Kenya).

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This picture shows the monthly water billing in an African water works during regular working time. Photographing “from behind” shows employees' activities besides or better instead of working. Low productivity results in lower wages, low wages result in lower productivity – a vicious circle.

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This is a sedimentation tank for sands in the inflow of a wastewater treatment plant in Maghnia (Northwest Algeria). The machine is (still) working but already visible deficiencies of maintenance will cause damage and disturb work sooner or later.
With the volume exceeding € 10 m, AKIZ is currently the largest BMBF-research project under the German-Vietnamese cooperation in the water sector. AKIZ is developing overall wastewater concepts for industrial zones (Abwasserkonzepte für Industriezonen) for tropical regions, with the IZ of Tra Noc located near Can Tho Airport in the Mekong-Delta. In countries like Vietnam, there are very many and large IZ emitting toxic substances and contaminated wastewaters polluting the environment.

AKIZ is elaborating a management concept, optimising the combination of decentralised near-to-source treatment and centralised wastewater purification. The IEEM - Institute of Environmental Engineering and Management at the Witten/Herdecke University is developing pilot projects, in cooperation with strong partners from industry and other universities, to recuperate energy, valuables and water, and to prevent and eliminate the discharge of hazardous substances onsite.
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**IEEM/AKIZ Industrial Partners:**

1. De-toxification of highly loaded industrial wastewaters
2. Anaerobic reactor/membrane filtration/biogas production
3. Pilot plot for the conversion of sewage sludge to organic soil
4. Detail design of a CW-SBR-tank
5. Layout drawing of the centralised wastewater treatment plant
6. ICP in the AKIZ-laboratory to analyse heavy metals
7. Laboratory container with analysis instrumentation in Tra Noc
The target of the BMBF-funded definition project "UWI India" is, to develop innovative technology and service concepts which might provide adaptable solutions for the severe problems in water and sanitation, which are prevailing in India due to the lack of appropriate, functioning urban water infrastructure.

The comparison of the needs in India with innovative technologies and services available in Germany will be the basis to define a reasonable programme to improve urban water infrastructure with selected solutions (technologies, service concepts) including modifications and measures to adapt these solutions from Germany to the specific needs in Tamil Nadu.
Based on the final communiqué of the Indo-German sustainability conference 2010 in New Delhi, in which 8 general fields of research with focus on the water sector have been defined, a list of 21 research topics for the Indo-German water research activities ("LongList") has been set up in close collaboration with several experts from science, industry and development cooperation. These 21 research topics have then been checked for compatibility with ongoing KfW activities in India. As result, 3 topics have been determined to be significantly relevant and interesting ("ShortList").

Afterwards, a "Fact-Finding-Mission" took place, with participation of KfW, the International Bureau of the BMBF and IEEM, during which different cities have been visited to observe the local working conditions as well as the interest of the end-users (urban water and sewerage utilities) for the 3 pre-selected topics.

According to the target priorities of the end-users and the local technological/organisational working conditions, the research topic "WaLUE – Water Losses in Urban Environment" has been determined as best qualified and has therefore been presented in a project outline including a specific working and financing concept.
**GPS-Coordinates:**
51°27'5.80"N
7°21'13.32"E

**Travelling by taxi:**
From S-station Bochum-Langendreer 5 min,
from S-station Witten-Annen Nord 5 min,
from central station Witten 10 min,
from central station Bochum 15 min,
from central station Dortmund 20 min,
from the airport Dortmund-Wickede 30 min,
from the airport Düsseldorf International 60 min.

**Travelling by public transportation:**
From central station Witten by bus No. 371 up to bus stop "Universität Witten-Herdecke".